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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/708,642
Filing Date: March 17, 2004
Appellant(s): CHUANG ET AL.

Winston Hsu
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 02/01/2008 appealing from the Office action mailed 03/09/2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. Claims 2-5, and 8-12 are also noted as on appeal in the Claims

Appendix section, therefor grounds of rejection for the dependent claims are offered below.

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

Claim 2 is also rejected under the 35 U.S.C. 103 over references Hong et al. (6,429,057), Rioux (5,554,488) and Kim et al. (4,981,816), applied to claims 1 and 21, further in view of Przybysz et al. (4,904,980).

Claims 3, and 9-12 are also rejected under the 35 U.S.C. 103 over references Hong et al. (6,429,057), Rioux (5,554,488) and Kim et al. (4,981,816), applied to claims 1 and 21, further in view of Hori et al. (5,445,710).

Claim 4 is also rejected under the 35 U.S.C. 103 over references Hong et al. (6,429,057), Rioux (5,554,488) and Kim et al. (4,981,816), applied to claims 1 and 21, further in view of Cheung et al. (5,354,417).

Claim 5 is also rejected under the 35 U.S.C. 103 over references Hong et al. (6,429,057), Rioux (5,554,488) and Kim et al. (4,981,816), applied to claims 1 and 21, further in view of Celii et al. (2003/0143853).

Claim 8 is also rejected under the 35 U.S.C. 103 over references Hong et al. (6,429,057), Rioux (5,554,488) and Kim et al. (4,981,816), applied to claims 1 and 21, further in view of Nagata et al. (JP405067590A).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,429,057	Hong et al.	8-2002
5,554,488	Rioux	9-1996
4,981,816	Kim et al.	7-2003
4,904,980	Przbysz	2-1990
5,445,710	Hori et al.	9-1995
5,354,417	Cheung et al.	10-1994
2003/0143853	Celii et al.	7-2003
JP405067590A	Nagata et al.	3-1993

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

Claims 1, and 21, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong in view of Rioux of USPN 5,554,488 and Kim et al. (4,981,816).

Hong et al. discloses a front end array process for making LCD panel (col.1, l.7-11), comprising: depositing a molybdenum-containing metal gate layer which consists of gate lines, gate pads, and gate electrodes that can have a single or multiple layered structure (as in Appellants' claim 21, see fig. 3, 22, 24, 26 or col.10, l.55-67), and is deposited on a silicon substrate (fig. 2, 10 or col.1, l.34-37). Hong teaches the use of photolithography masking (ab.) followed by dry etch (i.e. uses gas mixture, col.7, l.15-

45) to pattern the molybdenum-containing metal layer/s for forming both gate and data wire (i.e. word line, col. 11, l.20-25). Hong's first embodiment teaches use of dual layers (as in Appellants' claims 1 and 6) of Al-Nd and Mo-W, and it is known and preferable to use dry etch for this combination of materials (col.12, l.38-46). Hong teach etching to form said structures, which is written on substantially oblique sidewalls.

Hong does not explicitly recite substantially oblique sidewalls (as in Appellants' claim 1).

Rioux teaches a conventional method of forming Mo containing (col.5, l.57) metal gate (col.5, l.49) with tapered sidewalls (i.e. oblique sidewalls), illustrated in figure 2 and discussed in columns 1-2. Rioux teaches tapered side walls formed on the surface of a semiconductor substrate (i.e. glass; illustrated in figure 2, discussed in columns 1-2 and col. 6, lines 14-34; and col.5, l.34-35), through use of well known photolithography and dry etch methods (illustrated in figure 2 and discussed in columns 1-2 and col.6, l.14-34), as in claims 1, and 21).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the method of tapered sidewalls, of Rioux, when making the front end array process for making LCD panel, of Hong, because Rioux teaches it avoids undercutting, and etch damage in subsequent process (ab), an known process improvement.

Further, It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of etching , as Hong, to include the

sidewalls are tapered, as Appellants' claim, because Rioux teaches such methods of etching are known to be conventional, and Hong teaches etching to form a structure.

Kim et al. teaches a preferred etch resolution is achieved using RIE of molybdenum, etched until gas is cut off at the detection of the molybdenum “end-point” (see col. 3, lines 60-66), which is written on Appellants’ limitation etching molybdenum-containing metal layer is detected by an end-point detection method.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention making the front end array process for making LCD panel, of Hong, by including a step of etching molybdenum-containing metal layer is detected by an end-point detection method, as Appellants’ claim, because Kim et al. teaches it is a RIE method which achieves a preferred etch resolution9.

As to claim 21, Hong does not specifically point out top and bottom layers, as in Appellants’ claim 21, but Hong’s first embodiment teaches use of dual layers of Al-Nd and Mo-W (col.12, l.38-46), as in Appellants’ claim 7.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to form LCD panels with gate layers of dual materials, as in Hong, by selecting the order of deposition of the layers, the Aluminum containing film being first, the bottom layer, and the Moly containing film being second, the top layer, because Hong teaches the combination of materials in that specific order AL-Nd, first, then Mo-W, second.

Claim Rejections - 35 USC § 103

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong and Rioux (see discussions above) in view of both Kim et al. (US 2003/0122987) and Przybysz et al. (USPN 4,904,980).

The combined teachings of Hong and Rioux fail to disclose that dry etch includes an over etching when etching the Mo containing metal layer, as in claim 2.

Kim et al. teaches a fabrication method for forming an array substrate of a liquid crystal display. Kim teaches the over etching of Mo is known and common in prior art (p.0027, l. 4), as in claim 2.

Przybysz et al. teaches the step of overetch is commonly implored during the etching of Mo because it is necessary, to allow time for the pattern to become fully defined (Description of the preferred embodiments -paragraph 4).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to combine the overetch, as taught by Kim in prior art, with the liquid crystal display invention, of Hong and Rioux, because both Kim and Prybysz indicate it is a conventional process that will allow time for the Mo-containing pattern to become fully defined, which avoids line defects.

Claim Rejections - 35 USC § 103

Claims 3, 9, 10, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al. as applied above, in further view of Hori et al. of USPN 5445710.

The combined teachings of Hong and Rioux do not disclose the specific gas mixtures or ratio of claims 3, 9, and 10-12.

Hori et al. teaches dry etching methods for a substrate containing carbon; patterning the film through a resist mask; using gas plasma; with fluorine and O2 gases. Hori teaches an embodiment that includes chlorine, as well as fluorine and O2 gases. Hori teaches plasma etch with the presence of carbon atoms from a film. Hori also teaches etch gases containing fluorine atoms and oxygen atoms are mixed at an atomic ratio of fluorine to oxygen to 198:1 to 1:2. Hori's ratio range encompasses the range claimed in the instant invention. In example 3, Hori used a variety of gases with oxygen (O2-col.16, l.66), including: chlorine (Cl2-col.17, l.3), fluorine (SF6-col.17, l.3), and chlorine (Cl2) and fluorine (SF6) combined (col. l.18).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the LCD manufacturing method, disclosed by Hong and Rioux, by modifying the etchant gas mixtures and ratios, as taught by Hori, because Hori teaches combinations that improve the results of dry etching (col.1, l.18).

Claim Rejections - 35 USC § 103

Claims 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Cheung et al. (USPN 5354417).

The combined teachings of Hong and Rioux are silent about the etching of a molybdenum-containing metal layer executed under a process pressure higher than 25 mTorr, as in claims 4.

Cheung teaches use of SF6, HBr (col. 2, l.63), and an oxygen containing gas (col.2, l.64) for an improved selective etching of a substrate (col.2, l.60) having molybdenum-containing layer (col.2, l.61). Cheung teaches the combination of Cl2 and O2 is typical (col.1, l.21-22) but they cause problems including "reentrant" profiles (col.1, l.29-30). Cheung teaches the process pressure at a range of 1 mTorr to 300 mTorr when etching a molybdenum-containing metal layer, which is encompasses the range of higher than 25 mTorr, in claims 4

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to select an etch rate of greater than 25mTorr for etching the molybdenum-containing metal layer in the modified teachings of Hong because Cheung (5,354,417) illustrates such a pressure is effective for accomplishing the desired etch.

Claim Rejections - 35 USC § 103

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Celii et al. (USPA 10/282621).

The combined teachings of Hong and Rioux are silent about the dry etch being controlled by a source power, a bias power, process pressure, oxygen flow rate and flow rate of fluorine containing gas, as in claim 5.

Celii et al. teaches an exemplary approach to plasma etching that is bases on Cl2 and a fluorine gas, with an oxidizer such as O2, where he controls the process temperature (para.128, l.7). Celii teaches controlling the process pressure (para. 108,

l.8), the source power (para.108, l.10), and bias power para.108, l. 10-11), as in claim 5. Celii also teaches controlling gas flow rates (see pg. 9, tables 3-5) as in claim 5.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include that dry etch is controlled by source power, a bias power, process pressure, oxygen flow rate and flow rate of fluorine containing gas, as taught by Celii, with the method for producing a liquid crystal display device that includes a matrix substrate, disclosed by Hong and Rioux, because Celii teaches alterations and modifications of various aspects will occur to others skilled in the art (para. 176, l.2-3).

Claim Rejections - 35 USC § 103

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Nagata et al. (JP405067590A).

The combined teachings of Hong and Rioux fail to disclose the etching of the molybdenum-containing metal layer is detected by a detection method which will detect a wavelength of about 704 nm, as in claim 8.

Nagata et al. teaches the etching of a film that has a fluorocarbon with a peak of light emission in of about 700nm (ab.), which is very different than the ordinary resist wavelength of 480nm. Nagata teaches the use of a second material to conduct the etching and when the fluorocarbon film is exposed, an intensity of 704nm (ab.) is detected.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the end point detection method of Nagata, in an etch used to produce a liquid crystal display device, as disclosed by the invention of Hong and Rioux, because Nagata teaches even when a stepped area exists and the etch rate is not uniform, the end point can be easily and accurately be detected.

Although, the modified reference of Hong does not teach an example using the material molybdenum, it would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of forming the front end array process, as Hong, to include that molybdenum or molybdenum-containing material when forming the metal gate with tapered sidewalls (i.e. oblique sidewalls), formed on the surface of a semiconductor substrate (i.e. glass; col. 5, 1.34-35), because Rioux teaches use of molybdenum-containing material it is known to be functional and effective when used to form the metal gate with tapered sidewalls, formed on the surface of a semiconductor substrate. In absence of unexpected results it would be beneficial to use materials known to be effective and functional.

(10) Response to Argument

Appellant argues, on page 13-14, that the references of Hong et al. (6429057), Rioux (5554488) and Kim et al. fails to achieve the claimed limitation of substantially oblique sidewalls is the direct result of the uniformly etching of the molybdenum-containing metal layer, examiner disagrees. The reference of Hong teaches it is

preferable to use dry etching to form word lines (a structure with sidewalls) of moly-containing material. (col. 6, lines 14-34 and Background section). Hong may be silent as to the sidewalls being substantially oblique, however one of skill would recognize no perfect process exists and therefor etched sidewalls would be substantially oblique. Because of Hong's silence, the reference of Rioux was used to cure the deficiency of an explicit recitation. Taking the reference of Rioux in the entirety, one of skill would note the background and figures 1 to 2 as a teaching of conventional etching methods which use a controlled etch process, for the purpose of forming substantially oblique sidewalls. The teaching of Rioux also is used to point out that a variety of methods results in substantially oblique sidewalls. See figure 2, discussed in columns 1-2, and col. 6, lines 14-34. Appellant continue to argue that the reference of Rioux is not formed by etching. Please see Background sections col. 6, lines 14-34, for evidence that Rioux teaches use of etching to form the tapered (i.e. substantially oblique) sidewalls. Rioux does teach methods that form tapered (i.e. substantially oblique) sidewalls through deposition, as appellant argues, however Rioux also includes similar structure by etching methods.

Appellant argues, on page 13-14, 15, and 19, that the references of Hong et al. (6429057), Rioux (5554488) are improper combination because Hong is directed toward a method of dry etching, and Rioux is toward a method of deposition, examiner disagrees. Although Rioux does teach methods that form tapered (i.e. substantially oblique) sidewalls through deposition, as appellant argues, Rioux also includes teaching

of etching methods for forming tapered (i.e. substantially oblique) sidewalls. See figures 1 and 2; described in detail in the Background section, and col. 6, lines 14-34.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Patricia A George/

Examiner, Art Unit 1792

Conferees:

/Nadine G Norton/

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